APPENDIX B: ANSWER KEYS

ANSWER KEY: UNIT 1: POST-TEST

Directions: Answer each of the following questions. Each item counts 25 points. When you finish, check your answers in Appendix B. If you missed any items, refer to the applicable sections before you proceed.

---

1. Identify three ways in which hospitals may be involved in hazardous materials incidents.

   Any of the following answers is acceptable:

   Patients exposed or contaminated may arrive at the emergency department.

   The facility may be in the path of exposure of the release and may have to institute protective procedures.

   The facility may have to be evacuated.

   Hospitals will have to diagnose hazardous materials and determine the appropriate treatment.

2. Define hazardous materials.

   Hazardous materials are chemical substances that, if released or misused, can pose a threat to the environment, life or health.

3. List four federal regulations, standards, or agencies that regulate hazardous materials.

   Any of the following answers is acceptable:

   Code of Federal Regulations, SARA, OSHA, TSCA, Federal-agency issued regulations, standards and guidelines

4. Describe some of the health effects associated with hazardous materials.

   Heart ailments, kidney and lung damage, sterility, cancer, burns and rashes.

ANSWER KEY: UNIT 2: PRETEST

PART I

1. Match the DOT hazardous materials classifications with the correct description. (Each answer counts 10 points.)

DOT Hazardous Materials Classification	Description
__D__1. Corrosive Materials	a. A chemical that causes a sudden, almost instantaneous release of pressure, gas and heat when subjected to sudden shock, pressure, or high temperatures.
__E__2. Radioactive Materials	b. Solids likely to cause fires through friction or retained heat from manufacturing or processing or that are easy to ignite such as matches.
__B__3. Flammable Solids	c. Materials that readily yield oxygen to support combustion.
__C__4. Oxidizers	d. Liquids or solids that damage human tissue or steel on contact such as sulfuric acid.
__A__5. Explosives	e. Substances that emit alpha and beta particles and gamma rays spontaneously.

PART II

2. List four potential causes for mechanisms of harm from hazardous materials. (Each answer counts five points.)

   Any of the following answers is correct:
   Thermal Etiologic Asphyxiant Mechanical Chemical Psychological Radiological

3. List six sources of potential hazardous materials within the home, work facility, and community. (Each answer counts 5 points.)

   Any of the following is acceptable:

   Transportation incidents
   Automobiles
   Medical procedures
   Naturally occurring toxic substances
   Air
   Fixed facilities and storage
   Hazardous materials waste sites
   Consumer products
   Soil
   Ground and Surface Water

Exercise: Identifying Mechanisms of Harm Effects on the Body (Unit 2)

ANSWER KEY

All of the systems would be affected, except for psychological. In this situation, it would only apply to the neurological, respiratory, circulatory and digestive systems.

ANSWER KEY: UNIT 2: POST-TEST

PART I

Match the DOT hazardous classes with the appropriate description. (Each answer counts 10 points.)

DOT Hazardous Class	Description
__D__1. Flammable Gas	a. Anthrax, botulism, and polio virus
__E__2. Flammable Liquid	b. Flammable compounds that contain the double oxygen or peroxy group that are subject to explosive decomposition.
__B__3. Organic Peroxide	c. Matches or sulfur.
__A__4. Etiologic or Infectious Organism	d. Propane, methane, and hydrogen.
__C__5. Flammable Solid	e. Liquids with a flashpoint below 100 degrees F.

PART II

Match the potential mechanisms for harm according to their causes. Each answer counts 10 points.

Cause	Potential Harm
__B__1. Etiologic	a. Fireworks explode unexpectedly causing burns over 30 percent of the body.
__E__2. Asphyxiant	b. You are exposed to hepatitis on your visit to Malaysia.
__C__3. Radiological	c. Your basement contains excessive amounts of radon.
__D__4. Chemical	d. You spill nitric acid and it splashes into your eyes.
__A__5. Thermal	e. Your gas heater malfunctions and emits dangerous levels of carbon monoxide.

ANSWER KEY: UNIT 3: PRETEST

1. What is the purpose of a hospital emergency/disaster response plan?

   The hospital emergency/disaster plan describes the policies and procedures that should be followed in the event of a hazardous materials incident.

2. List five individuals or agencies that should be involved in the development of a hospital's emergency/disaster response plan.

   Any of the following individuals or agencies would be acceptable answers:

   - *Medical staff*
   - *Nursing administrator*
   - *Facility engineer*
   - *Housekeeping services representative*
   - *Food service administrator*
   - *Emergency department administrator*
   - *Security officers*
   - *Risk management advisor*
   - *Public affairs representative*
   - *Communications representative*
   - *Safety director*
   - *Senior management representatives*
   - *Field Emergency Medical Service providers*
   - *Fire and law enforcement officials*
   - *Representatives of the Local Emergency Planning Committee*
   - *Red Cross and human service agencies*
   - *Hazardous materials response teams*
   - *911 and emergency dispatch centers*
   - *Poison Control Centers*
   - *Air ambulance services*
   - *Other hospital and medical centers*
   - *Public health agencies*
   - *Visiting Nurse Associations*
   - *Emergency Management Agency*

ANSWER KEY: UNIT 3: PRETEST (continued)

3. List five basic elements that should be included in the hospital's emergency/disaster response plan.

   Any five of the following would be acceptable:

   - *Roles and Responsibilities of the Hospital and Staff*
   - *Organizational and Reporting Structure in an Emergency*
   - *Fire Plan*
   - *Procedures and Policies for Access to Emergency Care Areas*
   - *Communications Systems Alternatives (when main communication system fails)*
   - *Procedures to follow when Electrical, Air Conditioning, Plumbing, Boiler Systems, and Essential Life Support Systems fail*
   - *Procedures for Patient Management (scheduling, modification, discontinuation of services, control of patient information, and admission, transfer, and discharge of patients)*
   - *Evacuation Plan*
   - *Special Equipment Requirements (for Hazardous Materials Incidents)*

4. Why is it important to have a hospital emergency/disaster response plan?

   A hospital emergency/disaster response plan ensures that the facility is prepared to handle the expected and unexpected situations and needs that may occur during hazardous materials events.

5. What is the name or title of the individual who is responsible for the overall development of your hospital's emergency/disaster response plan?

   Your answers will vary.

Exercise: Interpreting the Hospital Emergency/Disaster Response Plan (Unit 3)

ANSWER KEY

Purpose: To become acquainted with a hospital emergency/disaster response plan.

Directions: Use your hospital's emergency/disaster response plan to answer the following questions. If you do not have a plan, use the sample plan in Appendix A.

1. Locate the section that identifies the personnel for response duties.
   Section III—Chemical/Radiation Hazards Response Team

2. Locate the section that defines the roles and responsibilities of personnel.
   Section II—Notification and Verification Responsibilities and
   Section III—Chemical/Radiation Hazards Response Team

3. Locate the section(s) that identifies the primary and secondary areas for patient reception triage and decontamination treatment.
   Section IV—Preparation of Chemical/Radiation Emergency Area (C/REA)

4. Locate the section(s) that identifies safety and security precautions that should be followed.
   Section IV—Preparation of Chemical/Radiation Emergency Area (C/REA) and
   Section V—Preparation of Chemical/Radiological Emergency Response Team

5. Locate the section(s) that identifies procedures for facility and personnel contamination control.
   Section IV—Preparation of Chemical/Radiation Emergency Area (C/REA) and
   Section VII—Decontamination of the Chemical/Radiological Emergency Response Team

Note: Your answers will vary if you use your hospital's plan.

ANSWER KEY: UNIT 3: POST-TEST

Directions: Answer each of the questions below.

(Check your answers in Appendix B. If you missed any items, you should review this unit before proceeding).

a) Which of the following documents would contain the policies and procedures that **you** should follow in your facility in responding to a hazardous materials incident?

a) JCAHO Accreditation Manual for Hospitals
b) Your hospital's emergency/disaster response plan
c) The state's code of regulations
d) The community emergency preparedness plan

a) Which of the following is not a basic component of the hospital's emergency/disaster response plan?

a) Basic plan
b) Supporting annexes
c) Implementing procedures
d) **Community fire and building codes**

a) Who should be involved in the development of the hospital's emergency/disaster response plan?

a) Only management representatives from each department in the hospital
b) All employees, including management and representatives from every department who may be involved in responding to a hazardous materials incident
c) Just emergency physicians and nurses
d) Primarily, the hospital administrator and security personnel

a) What is the purpose of the hospital's emergency/disaster response plan?

a) To provide details on how to control the spread of fires in the event of an emergency
b) To provide job descriptions for hospital personnel
c) To describe the policies and procedures to follow in the event of a hazardous materials incident.
d) To identify the community's fire and sanitation ordinances

ANSWER KEY: UNIT 4: PRETEST

Purpose: This pretest will assess your knowledge about issues and procedures in responding to hazardous materials incidents.

Directions: Read each item and answer accordingly. Each answer counts 20 points. *(If you score at or above the passing range of 85%, skip this unit and proceed to unit five. Do not check the Answer Key (Appendix B) until after you have completed the test.)*

1. When someone or something else comes in contact with someone or something else that has been contaminated, this is known as:
   a) cross contamination
   b) direct contamination
   c) residual contamination
   d) gross contamination

2. Removing a major amount but not all of the contaminant from the contaminated person or object is an example of:
   a) secondary decontamination
   b) gross decontamination
   c) full-stage decontamination
   d) level A decontamination

3. Chemical alteration of a hazardous material into a harmless substance is called _____.
   a) dilution
   b) degradation
   c) disinfection
   d) absorption

4. Which of the following is not a technique for contamination control?
   a) Monitor anyone or anything that leaves the controlled area.
   b) Control ventilation.
   c) Set up a controlled area large enough to hold the anticipated number of victims.
   d) Register all victims at the reception desk before sending them to the decontamination area.

5. List five members of the emergency response team.
   Any of the following is acceptable:
   Team coordinator, emergency physician, triage officer, nurse, technical recorder, safety officer, public information officer, administrator, security personnel, maintenance personnel, laboratory technician

Exercise: Who's Responsible for What? (Unit 4)

ANSWER KEY

Role Description	Team Member
__C__1. Secures the emergency area and controls crowds	a. Emergency Physician
__D__2. Leads, advises, coordinates	b. Public Information Officer
__A__3. Diagnoses, treats, and provides emergency medical care	c. Security Officer
__E__4. Records and documents medical, hazardous material, and radiological data radiological data	d. Team Coordinator
__B__5. Releases information to the media	e. Technical Recorder

Exercise: What's the Appropriate Method To Control the Spread of Hazardous Materials? (Unit 4)

ANSWER KEY

1. A wounded patient walks into the reception area. The patient says he just provided assistance at a hazardous materials accident, but was injured when some kind of chemical exploded. What should you do?

(a) Assume the patient is contaminated and immediately direct him or her back outside.
(b) Fill out the patient's information and insurance forms.
(c) Ask the patient to describe the type of accident he was providing assistance.
(d) Tell the patient to wait for the next available doctor.

2. You have been notified that you will be receiving 10 patients who have been exposed to some type of corrosive. What should you do first?

(a) Prepare the emergency area.
(b) Contact the security officer to control the crowds.
(c) Notify the public relations officer.
(d) Call the hazardous materials hotline.

3. Which of the following will not help to prevent the spread of contamination in a hospital?

(a) **Failure to close the air ventilation ducts in the emergency area.**
(b) Establishing a control zone for the decontamination area.
(c) Setting up a warm zone between the contaminated and non-contaminated area.
(d) Using strict isolation precautions including protective clothing.

Exercise: Why Do I Need a Sample? (Unit 4)

ANSWER KEY

Sample	Reason Required
__E__1. Routine urinalysis	a. In accidents involving radiation, to assess the radiation dose and establish a baseline
__C__2. Swabs from wounds	b. To assess respiratory tract contamination if inhalation of contaminant was a possibility
__B__3. Sputum	c. To determine if wounds are contaminated
__D__4. Serum creatinine	d. To assess kidney function if chelation is indicated
__A__5. Complete Blood Count	e. To determine if kidneys are functioning normally

Exercise: What Do You Know About Mechanisms for Decontamination? (Unit 4)

ANSWER KEY

Description	Term
__D__1. Process that neutralizes, degrades, or otherwise chemically alters the contaminant.	a. Absorption
__E__2. Destroys microorganisms and their toxins.	b. Dilution
__A__3. Penetration of liquid or gas into another substance.	c. Disposal
__C__4. Used more often to deal with contaminated clothing.	d. Degradation
__B__5. Reduces the concentration of the contaminant.	e. Disinfection

ANSWER KEY: UNIT 4: POST-TEST

1. When notified of a hazardous materials incident and the possible transport of patients, what should you do?

   a) **Get accurate and complete information from the person reporting the incident.**
   b) Call the local emergency management office to coordinate patient treatment.
   c) Notify the American Red Cross.
   d) Wait until the patients arrive before taking any action.

2. When a substance actually touches a body or thing, it is called

   a) Cross contamination
   b) Decontamination
   c) **Direct or primary contamination**
   d) Contaminated

3. Which of the following statements is not a characteristic of the emergency response team (ERT)?

   a) The composition of the ERT may vary from facility to facility.
   b) The hospital ERT must coordinate its efforts with field emergency response teams and other external agencies.
   c) The composition of the team, and the numbers of people needed will vary according to the magnitude of the situation.
   d) The ERT consists of a limited number of people, usually the triage officer, nurse, and emergency physician.

4. It is important to prepare an emergency area when dealing with hazardous materials incidents because:

   a) Special preparation techniques protect the attending staff, hospital facility, and equipment while preventing the spread of contamination.
   b) It will be easier for family members to see the patient.
   c) Doctors and nurses prefer to work in separate areas.
   d) It allows for continuous traffic flow and visitor movement within the area.

5. Protocol for "dirty" surgical cases is similar to the techniques applied in:

   a) Treating ill patients
   b) **Isolation of contaminated patients**
   c) Diagnosing wounded patients
   d) Triage

ANSWER KEY: UNIT 4: POST-TEST (continued)

6. To prepare a room for decontamination, you should:

   a) Turn off the ventilation system.
   b) Cover the movable equipment.
   c) Set up an open access area
   d) Avoid using control lines or control zones

7. Personal protection equipment should only be used when

   a) **Personnel have been trained in the OSHA requirements regarding its use**
   b) Poisonous vapors are present
   c) Instructed to do so by the ERT coordinator
   d) You perceive a danger

8. In dealing with hazardous materials incidents during patient assessment and triage

   a) You should follow routine procedures in all situations
   b) **You should care for noncontaminated patients like any other emergency case**
   c) You should take all patients to a decontamination area
   d) You should wait until you have details on the nature of the hazard before doing anything

9. Which of the following is **not** a reason you perform radiological and clinical laboratory assessments:

   a) To assess the biological effects
   b) **To identify abnormalities**
   c) To quantify radionuclide contamination, if exposed to radiation
   d) To aid in the detection of the hazard

10. When you perform gross decontamination, you

    a) **Remove or alter chemically the majority of the contaminant**
    b) Remove all traces of the contaminant
    c) Ensure that cross contamination does not occur
    d) Create potential hazards

ANSWER KEY: UNIT 5: PRETEST

Directions: Answer each question. Each answer counts 20 points. After you have completed the test, check your answers in Appendix B.

1. Can incorporation occur without contamination? Explain your answer.

   No, you must be contaminated before incorporation occurs, because some part of your body must come in contact with a hazardous material.

2. What are the three most common types of ionizing radiation?

   Alpha, bet, and gamma particles

3. What is the most penetrating type of ionizing radiation?

   Gamma particles

4. List two units of quantity of measuring radioactivity.

   Curie and Becquerel

5. List three elements of radiation protection.

   Time, Distance and Shielding

Exercise: Identifying Types of Radiation Injuries (Unit 5)

ANSWER KEY

Purpose: To assess your understanding of the types of radiation injuries.

Directions: Answer each question. You can check your answers in Appendix B. If you missed any, review this section before continuing.

1. Mary had a series of x-rays taken during her visit to the emergency room. What type of radiation exposure did she receive?

   External irradiation

2. Jim spilled a radioactive material on his skin. Is Jim contaminated or exposed or both?

   Jim would be both contaminated with radioactive material, and exposed to radiaiton.

3. Three school children accidentally picked up an unbroken, sealed container that had dropped off a truck that was carrying radioactive materials. Is it possible that they could experience incorporation? Why or why not?

   No, it is unbroken and sealed; there is no release of radioactive materials. The only hazard would be exposure.

Exercise: How Well Do You Know Your Physics? (Unit 5)

ANSWER KEY

Purpose: To assess your understanding of basic radiation physics.

Directions: Answer each item. Check your answers in Appendix B. If you missed any items, review this section before continuing on to the next section.

1. How do unstable atoms become stable?

   By emitting radiation.

2. Which type of ionizing radiation is the least penetrating?

   Alpha particles

3. What is the SI unit that measures the amount of radioactivity?

   Becquerel

4. What is the unit for radiation absorbed dose in SI units?

   Gray

5. What are two biological-effects units of absorbed radiation?

   Sievert and Rem

Exercise: Are You in Danger? (Unit 5)

ANSWER KEY

Purpose: To check whether you can apply the basic concepts of radiation protection.

Directions: Answer each question. Check your answers in Appendix B. If you missed any items, review this section before continuing on to the next unit.

True or False

__T__1. The longer a person remains in the radiation field, the more radiation the person will accumulate.

__F__2. Surgical clothing will stop the penetrating gamma radiation.

__F__3. Lead is not an effective shield against alpha radiation.

__F__4. The quantity of radiation has little effect on the exposure rate from a given radioactive material.

__T__5. The radiation dose rate increases as your distance from the source decreases.

ANSWER KEY: UNIT 5: POST-TEST

Directions: Answer each question. Each answer counts 10 points. Check your answers in Appendix B. If you missed any items, review this unit before taking the final examination.

1. John used a survey meter to measure the amount of radiation present and found none. Later, Sue used a different same meter and found significant amounts of radiation. What could have caused the differences in the readings?
   - **a) John's meter was not working properly.**
   - b) Radiation had time to register in the body because of the time that passed between the two readings.
   - **c) Sue's body or clothing were contaminated with radioactive material.**
   - **d) John did not use the proper type of meter to detect the type of radiation being emitted.**

2. Which of the following would expose you to the highest dose of radiation?
   - a) Chest X-rays
   - b) **Gamma rays**
   - c) Beta particles
   - d) Alpha particles

3. Which of the following is the highest source of radiation (on an annual basis)?
   - a) Living in Chicago
   - b) X-rays and nuclear medicine
   - c) Living near a nuclear power plant
   - **d) Radon in an average household**

4. What is the largest source of man-made radiation?
   - a) **Radiation used in medicine**
   - b) Nuclear power plants
   - c) Scientific research
   - d) Mining

ANSWER KEY: UNIT 5: POST-TEST (continued)

5. Which of the following takes priority in the treatment?
   a) Nausea and vomiting caused by exposure to 15 Gy external irradiation
   b) **Tension pneumothorax**
   c) Superficial leg laceration
   d) Decontamination

6. Which of the following particles pose an external and internal hazard?
   a) Beta particles
   b) Alpha particles
   c) **Beta and gamma particles**
   d) Alpha and beta particles

7. The rad, rem, and gray are measures of what?
   a) **Absorbed dose**
   b) Units of exposure
   c) Amount of radioactivity
   d) Degrees of radiation

8. An important goal of emergency responders in dealing with radiation-related incidents should be to:
   a) Protect the public
   b) Save lives at any cost
   c) **Keep their own radiation exposure ALARA**
   d) Treat all patients as emergency care victims

9. What is the EPA recommended maximum dose for any single life-threatening emergency?
   a) 5
   b) 10
   c) **25**
   d) 50

10. What happens at the fourth stage in acute radiation syndrome?
    a) **Recovery or death**
    b) Nausea and diarrhea
    c) Weakness
    d) Gastrointestinal syndrome